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- 40 Minutes, No materials allowed. (Number) indicated

- \* For each, indicate where data comes from. Provide the type of addressing mode. Assume that  $[X] = 0200_{16}$ . (0.4)
- LDAA #52D. Immediate addressing. Data comes directly from program.
  - LDAA \$7C. Direct addressing. Data comes from memory location 007C.
  - LDAA \$57BB. Extended addressing. Data comes from memory location 57BB.
  - LDAA \$3F, X. Indexed addressing. Data comes from memory location 023F.

- \* Calculate the value of the offset byte portion of the BEQ instruction. (1)

$0310 + 56 = 037B$  we want opposite way so  
 $FF - 56 + 1 = \boxed{AA}$  complement 54.

0370	START	10	SBA
0371		27 ??	BEQ \$031D
0373		97 50	STAA \$50
0375	END	3E	WAI

- \* Show how the JSR instruction can be replaced by a BSR instruction with appropriate offset. The op code for

BSR is 8D. (1)

BSR only takes 2 bytes so all  
 program lines will be moved  
 back by 2 so we want to branch  
 to location C15F.

$C15F - C104 = \underline{5B}$  8D 5B

C100	MAIN	96 A6	LDAA \$A6
C102		BD C1 60	JSR \$C160
C105		97 A7	STAA \$A7
C107	END	3E	WAI
:	:	:	:
:	:	:	:
C160	SHIFT	44	LSRA
C161		44	LSRA
C162		39	RTS

- \* When the MPU executes a JSR command it saves the return address (PC contents) on the Stack, jumps to the Subroutine, and executes the code. At the end of the Subroutine, the RTS command causes the MPU to take the return address off the Stack, place it back in the program counter, and continue execution of the main program. (1)

- \* Describe two ways to halt execution of a program in MC68HC11. (0.6)

WAI command will halt the execution of a program.

Smashing the MC68HC11 with a hammer will halt execution as well.

- \* Consider the following instruction sequence. Determine where the program will branch to for each of the following values of unsigned data in memory location 0050. (1.5)

0.5 GB(a) 95.  $C607 + D6 = \boxed{C6DD}$ .

0.5 49(b) B7.  $C609 + 6B = \boxed{C674}$ .

0.5 4F(c) E1.  $C607 + D6 = \boxed{C6DD}$ .

C600	START	96 50	LDAA \$50
C602		43	COMA
C603		81 48	CMPLA #48
C605		22 D6	BHI \$????
C607		27 55	BEQ \$????
C609		20 6B	BRA \$????

THE END